

REMARKS

The invention relates in part to assay devices that utilize mass transport by laminar flow of a sample across and through the layers of the device. Because laminar flow overcomes limitations in sensitivity caused by diffusion boundary formation as an analyte binds to a surface, the devices of the present invention can provide advantageous analyte capture efficiencies. In certain embodiments, the devices comprise an optically functional layer containing components that produce a signal upon analyte binding.

Claims 1-12, 18-34, and 36-50 are under consideration by the Examiner, claims 13-17 and 35 having been removed from consideration subject to a restriction requirement. Applicants respectfully request reconsideration of the claims in view of the following remarks.

Art-Related Remarks

35 U.S.C §102

Brecht et al.

The Examiner has rejected claims 1, 2, 18-20, 23, 24, and 36 under 35 U.S.C §102(b) as allegedly being anticipated by Brecht *et al.* (Anal. Chim. Acta, 1995, vol. 311, pp 289-299). Applicant respectfully traverses this rejection, because the Brecht *et al.* reference does not disclose devices comprising a support containing channels that allow laminar flow of a sample through the support. Moreover, the devices discussed by the Brecht *et al.* reference cannot provide true laminar flow of a sample across a device surface.

In order to anticipate a claim, a single prior art reference must provide each and every element set forth in the claim. Furthermore, the claims must be interpreted in light of the teachings of the specification. *In re Bond*, 15 USPQ2d 1566, 1567 (Fed. Cir. 1990). *See also* MPEP § 2131.

The devices of claims 1, 2, 19-20, 23, 24, and 36 comprise a support containing channels, and an optically functional layer positioned on the support, such that laminar flow of a sample is

permitted through the layers of the device. *See, e.g.*, specification, page 8, line 25, through page 9, line 4. In contrast, the Brecht *et al.* reference discloses a glass surface mounted on a flow cell. Brecht *et al.*, page 292, "Setup." Unlike the instantly claimed devices, reagent flow in the devices of the Brecht *et al.* reference does not occur through the layers of the device, but rather across the device surface. *Id.* ("Glass chips were mounted on a flow cell with the interference layers facing the cell volume, [with] inlet and outlet at opposite sides of the cell lumen"). Therefore, because the Brecht *et al.* reference does not disclose devices comprising a support containing channels that allow laminar flow of a sample through the support, claims 1, 2, 19-20, 23, 24, and 36 are not anticipated by Brecht *et al.*

Moreover, with regard to claim 18, although the Brecht *et al.* reference describes one of the flow cells used as a "laminar flow" cell, the ordinarily skilled artisan would understand that the devices disclosed by the Brecht *et al.* reference cannot provide true laminar flow. Laminar flow requires that there be no macroscopic mixing of fluid particles caused by turbulent motion. *See, e.g.*, R.M. Olson, *Essentials of Engineering Fluid Mechanics*, Fourth Edition, Harper & Row, New York, 1980, pages 82-83 and page 219 ("Smooth, quiet flows without lateral motions which cause mixing are known as *laminar* flows... Flows with random or irregular fluctuations of mechanical quantities... are known as turbulent flows.") The devices disclosed by the Brecht *et al.* reference exhibit irregular, turbulent flow. For example, the Brecht *et al.* reference states that, due in part to irregularities in flow, no increase in analytical performance was gained using the "laminar flow" cell. Brecht *et al.*, page 296, right column. Instead, any improvement in signal is completely degraded by a large increase in the standard deviation of the measurements. *Id.* Irregular, turbulent flow in the devices disclosed by the Brecht *et al.* reference is likely caused by eddies created due to volume expansion at the point of fluid entry into the flow cell (*see, e.g.*, Olson, page 307) and at the point of fluid exit (*Id.*, page 306), and also by placement of the sensing chip in the device. Furthermore, the devices disclosed by the Brecht *et al.* reference utilize a high flow rate (20 μ L/min in a 150 nL flow cell; equal to 133 flow cell volumes/min), which is also incompatible with true laminar flow. *See, e.g.*, Olson, page 220 (Turbulent flow "is associated with high fluid velocities.").

Thus, the ordinarily skilled artisan would understand that the devices disclosed by the Brecht *et al.* reference cannot provide laminar flow. Additionally, it is precisely the non-specific binding and sensitivity problems associated with turbulent flow devices, such as those disclosed by the Brecht *et al.* reference, that are overcome by the instantly claimed devices. *See, e.g.*, specification, page 3, line 6, through page 4, line 8.

Therefore, because the Brecht *et al.* reference does not disclose devices that allow laminar flow of a sample, either through or across the device surface, claims 1, 2, 18-20, 23, 24, and 36 are not anticipated by Brecht *et al.* Accordingly, Applicants respectfully request that the rejection of claims 1, 2, 18-20, 23, 24, and 36 under 35 U.S.C §102(b) be withdrawn.

Kline *et al.*

The Examiner has also rejected claims 3-6, 9, 21, 22, 25, and 26 under 35 U.S.C §102(b) as allegedly being anticipated by Kline *et al.* (U.S. Patent No. 5,459,078). Applicant respectfully traverses this rejection, because the Kline *et al.* reference does not disclose devices comprising an optically functional layer positioned on a support.

The devices of the instantly claimed invention comprise an optically functional layer, described in the specification as "a layer which can produce a signal upon the binding of an analyte to a receptive layer." *See, e.g.*, specification, page 10, lines 4-23. Suitable optically functional layers are described in detail in the specification beginning on page 29, line 26. Thus, in the instantly claimed devices, changes in the optical characteristics of the optically functional layer itself (for example, changes in reflectance, transmittance, or polarization of light) provide a signal upon analyte binding. *See, e.g.*, specification, page 30, lines 1-15. In contrast, the devices disclosed in the Kline *et al.* reference do not contain an optically functional layer, but rather rely on indicator reagents to produce a signal. Such indicator reagents are bound to a membrane surface by charged capture agents. *See, e.g.*, Kline *et al.*, column 10, lines 14-38.

Therefore, because the Kline *et al.* reference does not disclose devices comprising an optically functional layer positioned on a support, claims 3-6, 9, 21, 22, 25, and 26 are not

anticipated by Kline *et al.* Accordingly, Applicants respectfully request that the rejection of claims 3-6, 9, 21, 22, 25, and 26 under 35 U.S.C §102(b) be withdrawn.

McGill *et al.*

The Examiner has also rejected claims 38-50 under 35 U.S.C §102(e) as allegedly being anticipated by McGill *et al.* (U.S. Patent No. 5,459,078). Applicant respectfully traverses this rejection, because the McGill *et al.* reference is not prior art under 35 U.S.C §102(e) with respect to claims 38-50.

Claims 38-50 describe devices comprising an attachment layer comprising diamond-like carbon. The instant application is a continuation-in-part of U.S. Application No. 08/742,255, filed October 31, 1996. Support for the instantly claimed devices can be found in the parent application, for example, on page 30, lines 28-29, and page 32, lines 8-14. Thus, claims 38-50 are entitled to the October 31, 1996 filing date of the parent application. Because the filing date of the McGill *et al.* reference is May 27, 1997, the reference is not prior art under 35 U.S.C §102(e) with respect to claims 38-50. Accordingly, Applicants respectfully request that the rejection of claims 38-50 under 35 U.S.C §102(e) be withdrawn.

35 U.S.C §103

The Examiner has rejected claim 7 under 35 U.S.C §103(a) as allegedly being unpatentable over Brecht *et al.* in view of Goddard *et al.* (Analyst, 1994, vol. 119, pp. 583-588); and claims 8, 10-12, 27-34, and 37 as allegedly being unpatentable over Brecht *et al.* in view of Goddard *et al.* in further view of Buechler *et al.* (U.S. Patent No. 5,458,852) and Finlan (U.S. Patent No. 5,055,265). Applicant respectfully traverses this rejection, because the Brecht *et al.* reference, alone or in combination with the secondary references cited by the Examiner, does not disclose or suggest devices comprising a support containing channels that allow laminar flow of a sample through the support, or that provide true laminar flow of a sample, either through or across the device surface.

To establish a *prima facie* case of obviousness, three criteria must be met: there must be some motivation or suggestion, either in the cited references or in knowledge available to one skilled in the art, to modify or combine the cited references; there must be a reasonable expectation of success in combining the references to achieve the claimed invention; and the references must teach or suggest all of the claim limitations. *In re Vaeck*, 20 USPQ2d 1438 (Fed. Cir. 1991); MPEP § 2143.

As discussed above, the Brecht *et al.* reference does not disclose, or even suggest, devices comprising a support containing channels that allow laminar flow of a sample through the support. Moreover, the ordinarily skilled artisan would understand that the devices disclosed by the Brecht *et al.* reference cannot provide true laminar flow, as instantly claimed. Furthermore, the secondary references cited by the Examiner do not cure the limitations of the Brecht *et al.* reference; nor does the Examiner contend that they do so. Therefore, because the cited references fail to teach or suggest all of the claim limitations, the Examiner has failed to establish a *prima facie* case of obviousness.

Accordingly, Applicants respectfully request that the rejection under 35 U.S.C §103(a) be reconsidered and withdrawn.

CONCLUSION

In view of the above remarks, Applicants respectfully submit that the pending claims as amended herein are in condition for allowance. An early notice to that effect is earnestly solicited. Should any matters remain outstanding, the Examiner is encouraged to telephone the undersigned at (619) 552-8400 so that they may be resolved without the need for additional action and response thereto.

Respectfully submitted,

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